Schweizerische Eidgenossenschaft
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Federal Department of Home Affairs FDHA
Federal Office of Public Health FOPH
Consumer Protection Directorate

Measures taken by the authority to reduce extremity doses in nuclear medicine facilities in Switzerland

Dr. phil nat Nicolas Stritt

Swiss Federal Office of Public Health (SFOPH)
Division Radioprotection

Division of Radioprotection of the SFOPH

- SFOPH is the authority which deals with all aspects related to ionizing radiation in industrial, medical & research sectors:
  - Regulatory body
  - Provides advice on how to comply with legislation
  - Audits, inspections, investigations
  - Takes enforcement action
- Manage licenses for
  - X-ray units, CT, PET
  - Therapeutics units
  - Accelerators
  - Use of radioactive substances

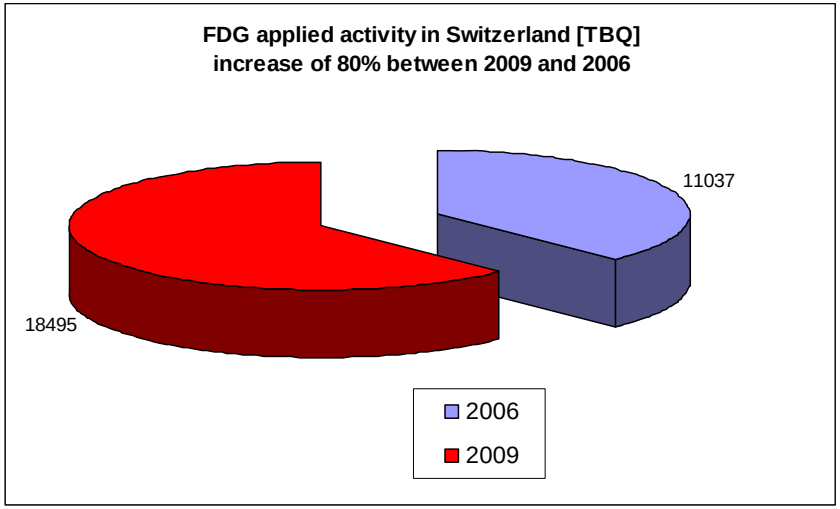
Use of radiopharmaceuticals in Switzerland

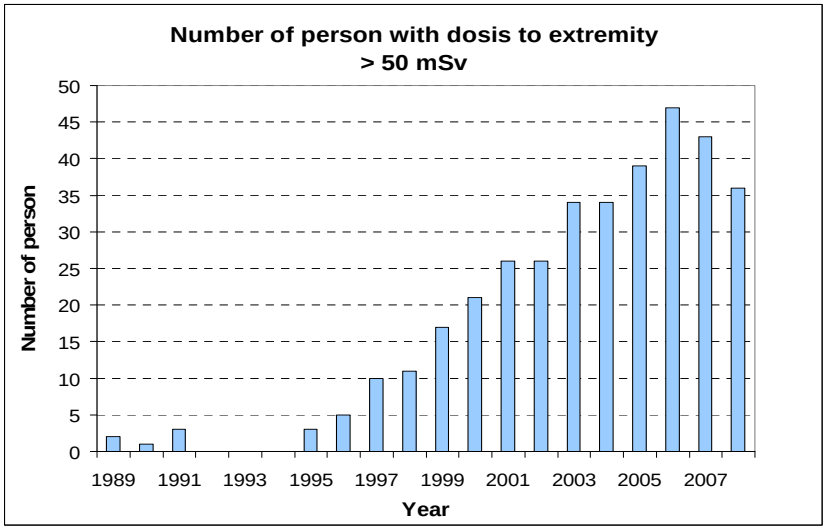
- Development of new therapeutic applications with **beta-emitters** and other nuclides
  (Y-90, Lu-177, Sm-153, Re-186)

- Spread and increase of **F-18** PET/CT-examinations
  (5 PET in 2000, 20 PET-CT in 2010)

- Continuous increase of extremity doses of medical staff

- Start of **optimization program** by the SFOPH
  (70 nuclear medicine centers)





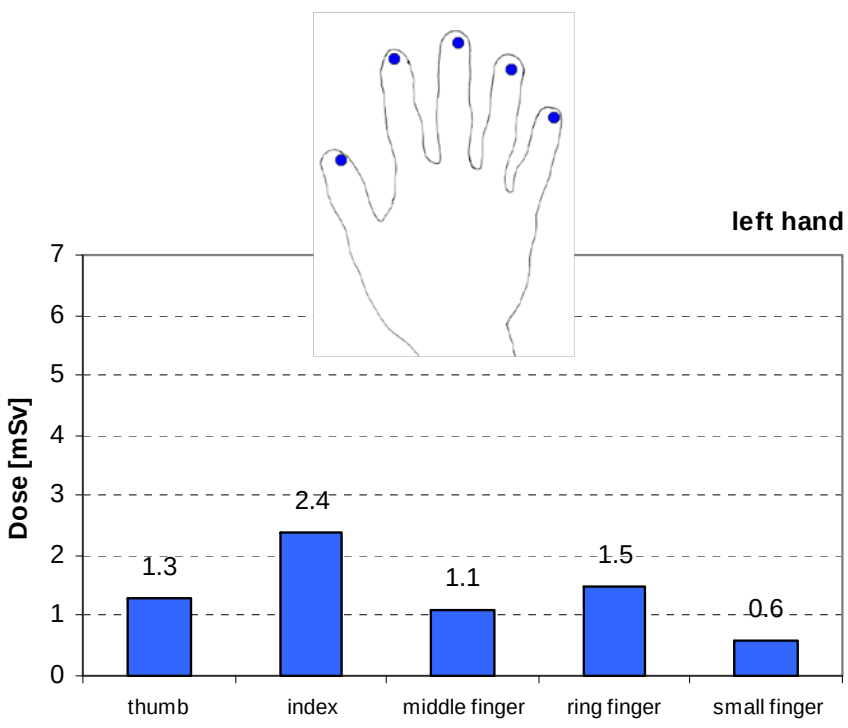
Audit of the SFOPH

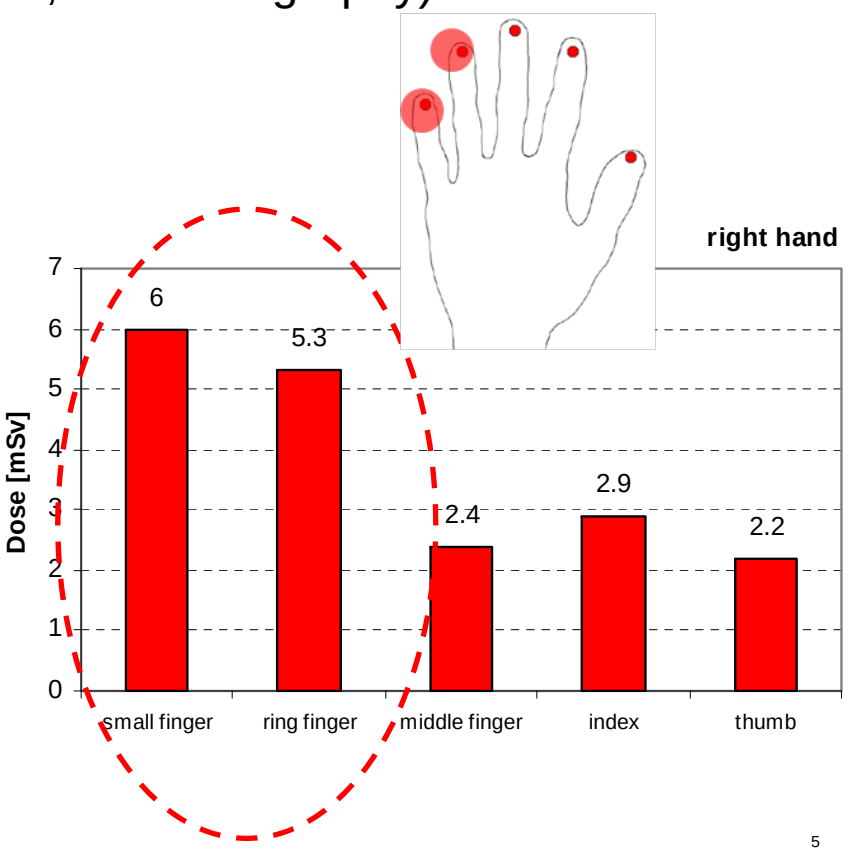
In order to clarify which manipulations lead to high hand doses, audit were performed in nuclear medicine

- Provide fingers tips dosimeter and measurements were made for Zevalin (Y-90) and FDG (F-18)
- Video of the manipulation in order to discuss with the RPO
- Training purposes for medical staff
- Optimisation purposes

Measurements of finger tips doses with Zevalin, labelling

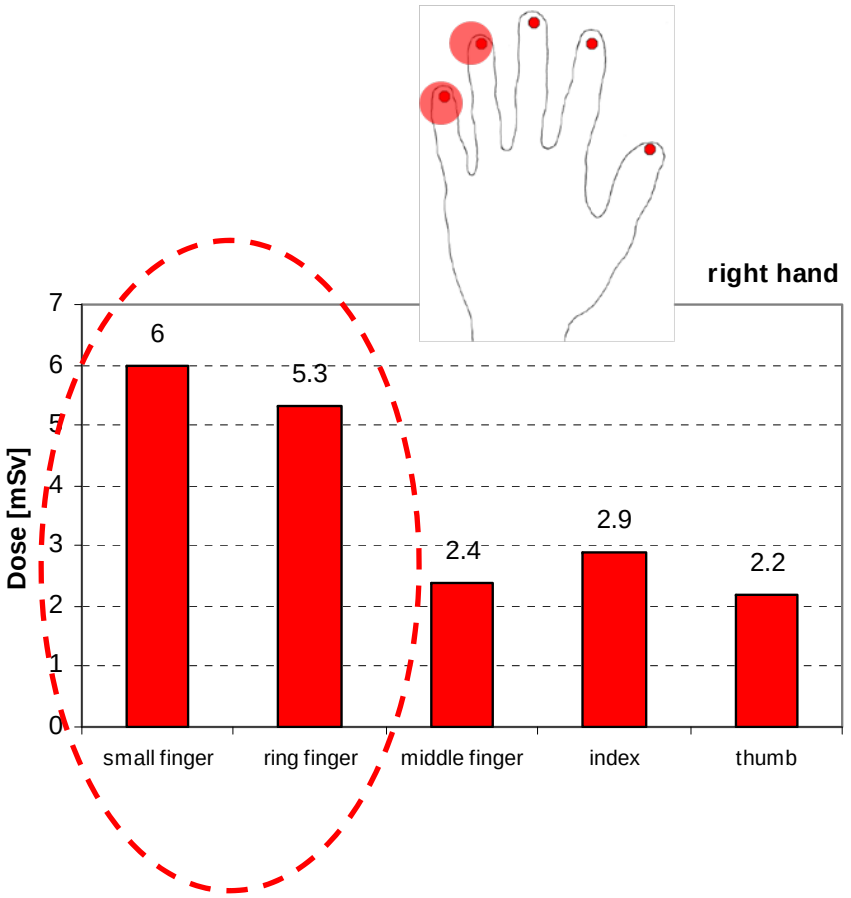
- Zevalin beta emitters used for therapy: Y-90
- Preparation of an activity: 300 MBq from a vial containing 2 GBq
- Duration: 45 minutes
  (labelling, calibration, syringe preparation, chromatography)





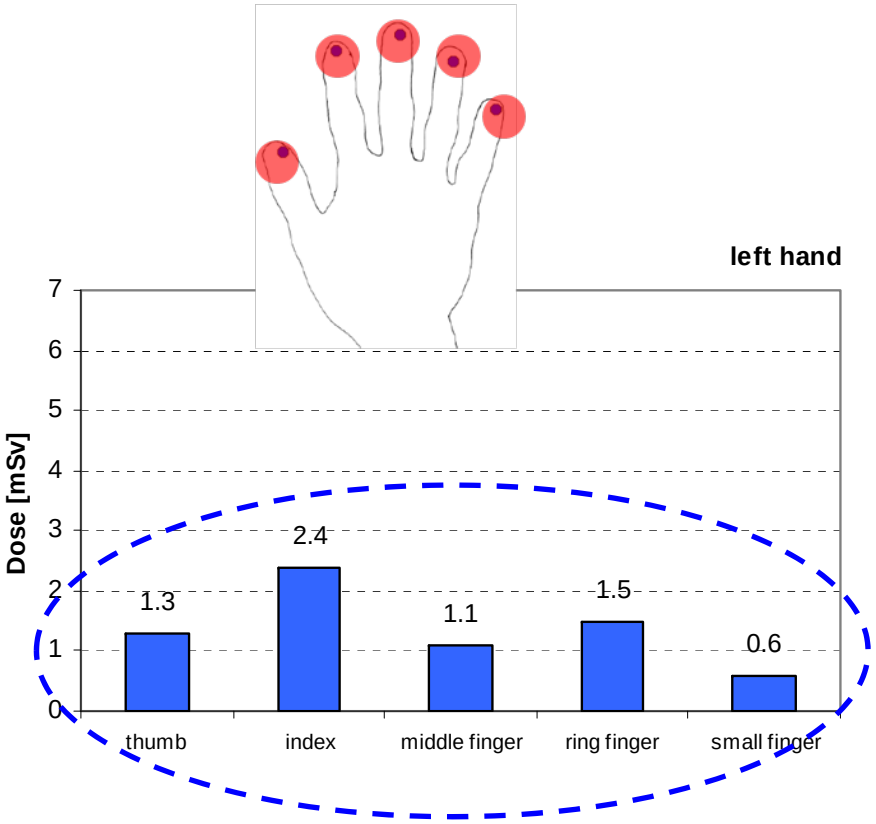
Measurements of finger tips doses with Zevalin, labelling

- Right hand holding the vial
- Holding of the vial, small finger and ring finger in close contact with the activity



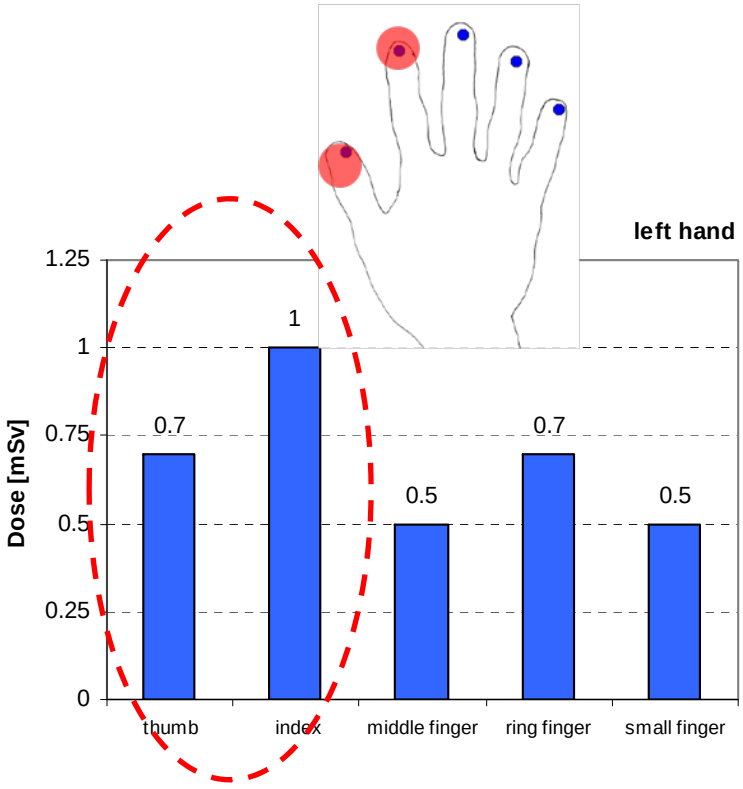
Measurements of finger tips doses with Zevalin, labelling

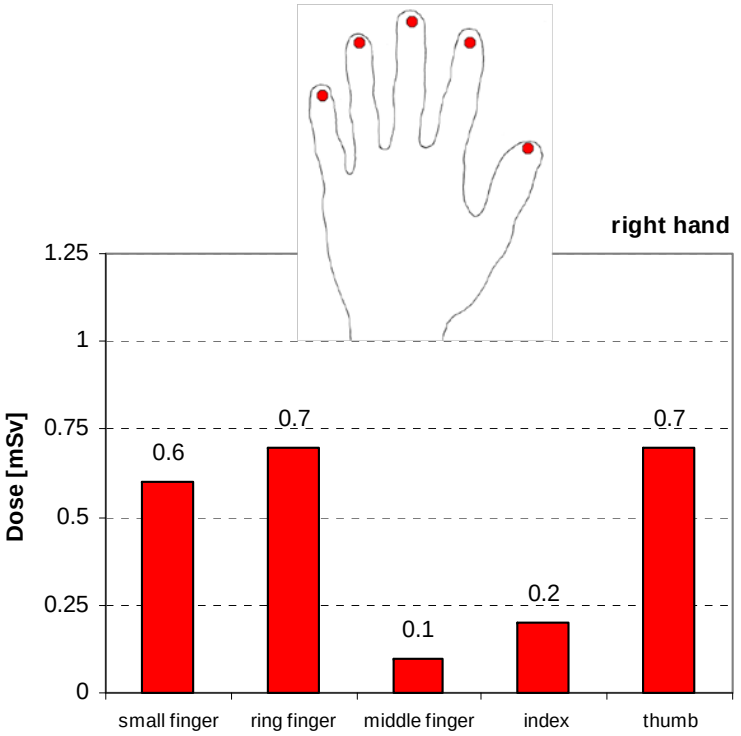
- Left hand holding the syringe
- No Plexiglas shielding on the syringe



Measurements of finger tips doses with Zevalin, application

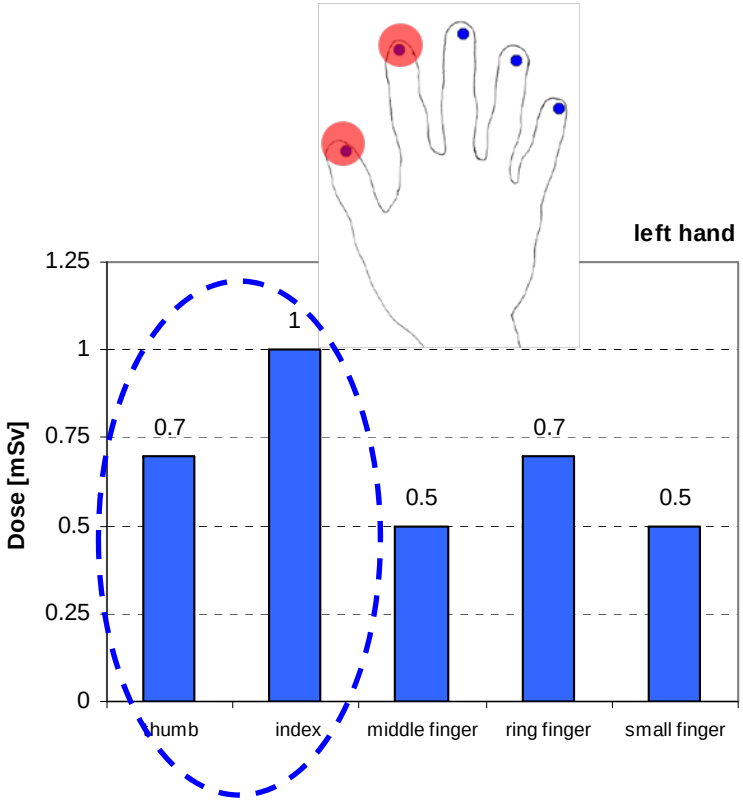
- Injection to patient
- Activity: 300 MBq
- Application time: 10 minutes





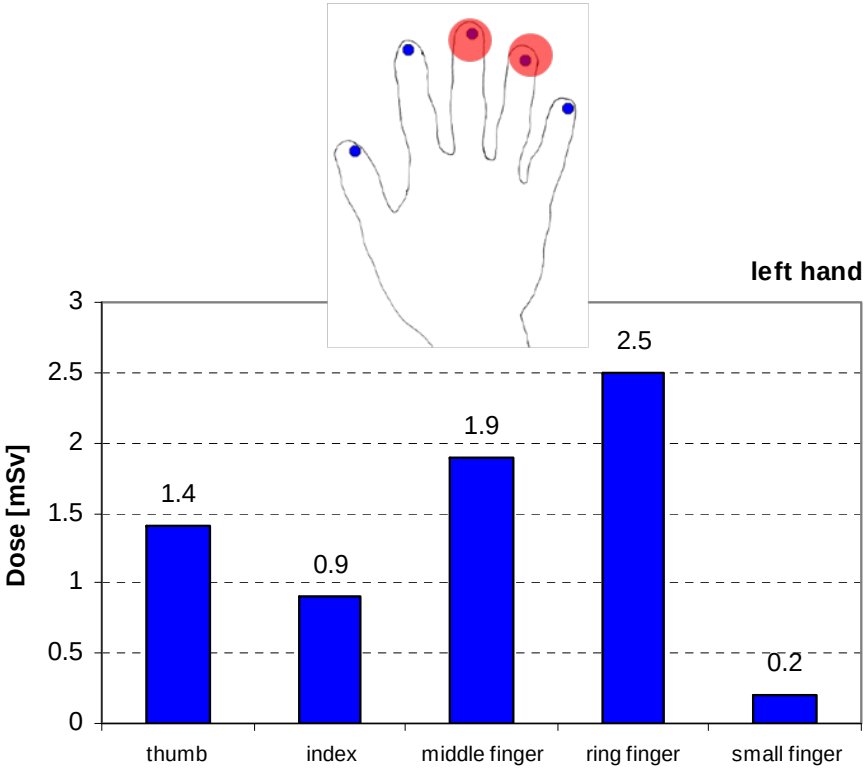
Measurements of finger tips doses with Zevalin, application

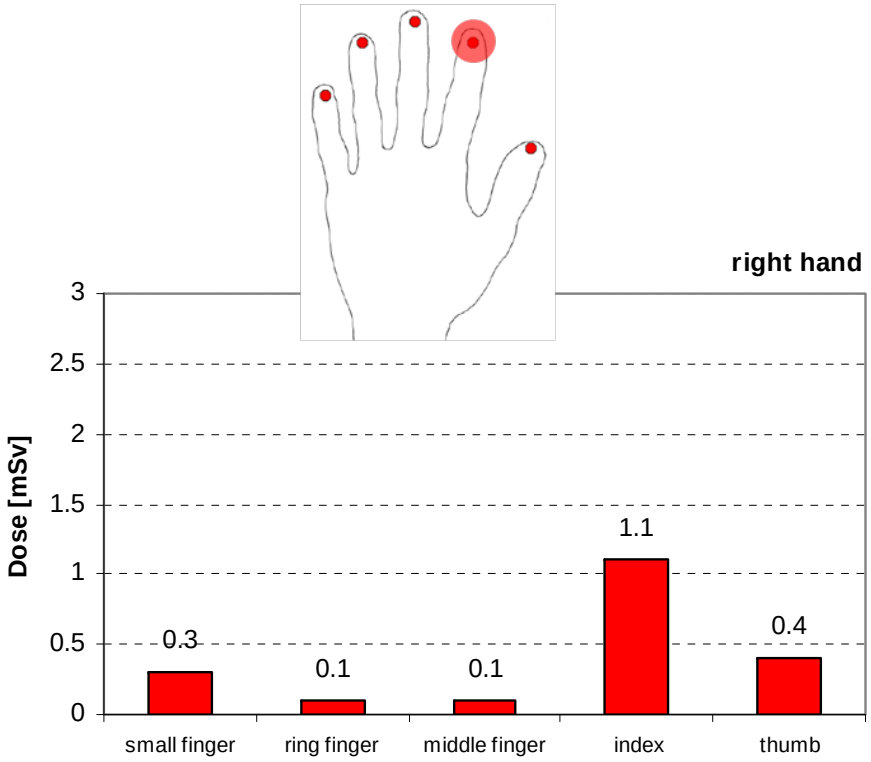
- Left hand holding the 3 way stopcock
- Thumb and index exposed



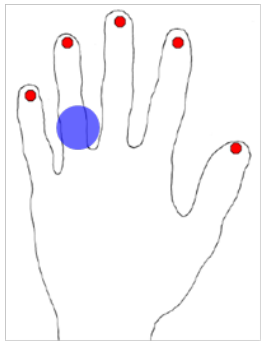
Measurements of finger tips doses with FDG, preparation

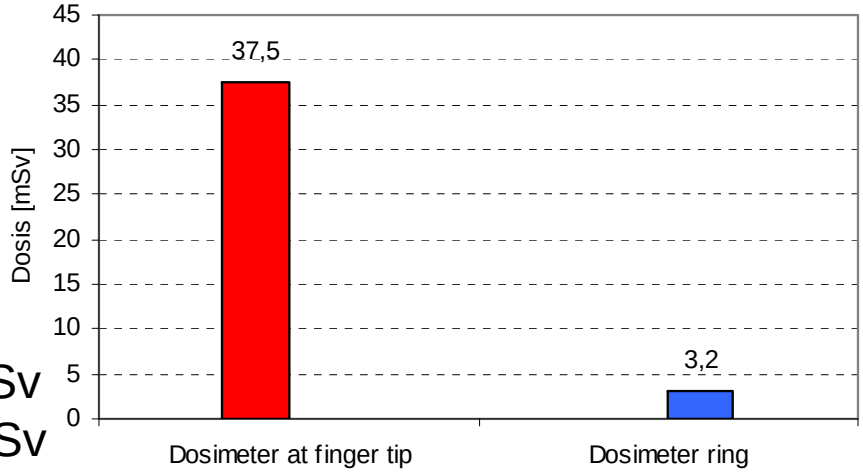
- FDG (F-18) preparation of 4 doses, 370 MBq from a vial containing 25 GBq
- Duration: 3 minutes per preparation (calibration, syringe preparation)





Comparison finger tips and official ring dosimeter, F-18, preparation



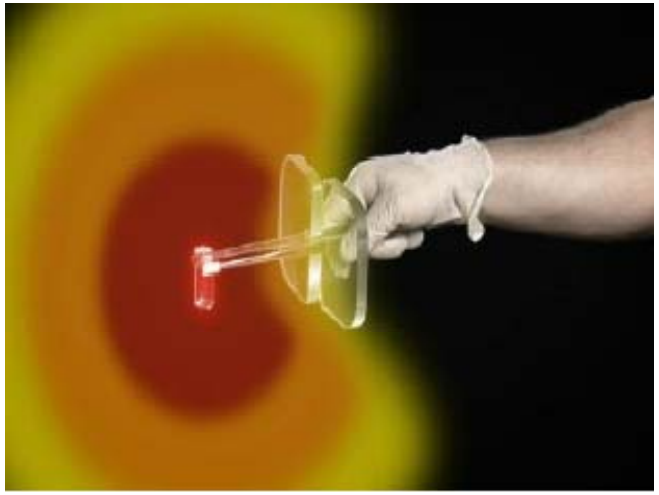


- Extremity dose per month
- Maximal measurement at finger tip:
  - 4 patients, max. index finger: 2.5 mSv
  - 60 patients per month (norm): 37.5 mSv
- Measurement official ring dosimeter
  - Measure during one month: 3.2 mSv
  - Many other manipulations are made during the month

- Ratio of measurement max finger tip / ring finger: **10**
- **Underestimation of the dose**

Results from the audit

- When working with beta-emitters, Plexiglas shielding as well as tongues should be used
- Manipulation of a few seconds of the therapeutic activity can lead to an extremity dose of several mSv



Results from the audits

- The dose rate to hands can be reduced by a factor 1000 by using the appropriate tools with beta (shielding, tongues, etc)
- Contrary to widely spread opinion, the time factor does not play a major role when suitable shielding is used

Without shielding | with shielding

Results from the audits

With a high patient turnover, and the corresponding increased quantities of radiopharmaceuticals, some manipulations should be automated

Measure taken by the regulatory body after audit/measurements

Publication information tools such as:

- Guideline with recommendations on how to reduce extremity doses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Eidgenössisches Departement des Innern EDI
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Direktionsbereich Verbraucherschutz

Seite 1 / 7

Abteilung Strahlenschutz
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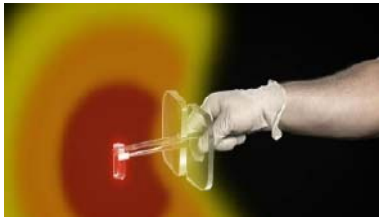
Merkblatt L-10-04
Empfehlung zur Reduktion der Extremitätendosen in der Nuklearmedizin

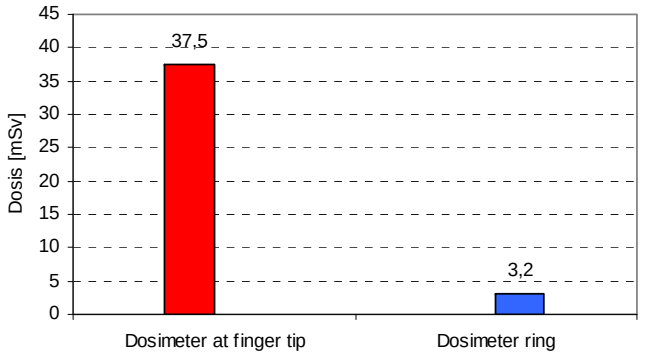
- Information DVD was produced with example of good practice and suggestions to reduce the extremity doses

- Distribution to all nuclear medicine departments

Conclusion

- Increase of extremity doses in Switzerland
- Measures taken by the authority:
  - Audit in the nuclear medicine department
  - Training (DVD, etc)
  - Measurement of finger tips doses
  - Video and optimisation discussion with RPO about
    - Use of appropriate shielding
    - Use of appropriate automatic device
    - Optimisation possible on all steps (labelling, calibration, chromatography, injection, etc.)
    - Underestimation of the finger dose
    - Further optimisation needed





Conclusion (2)

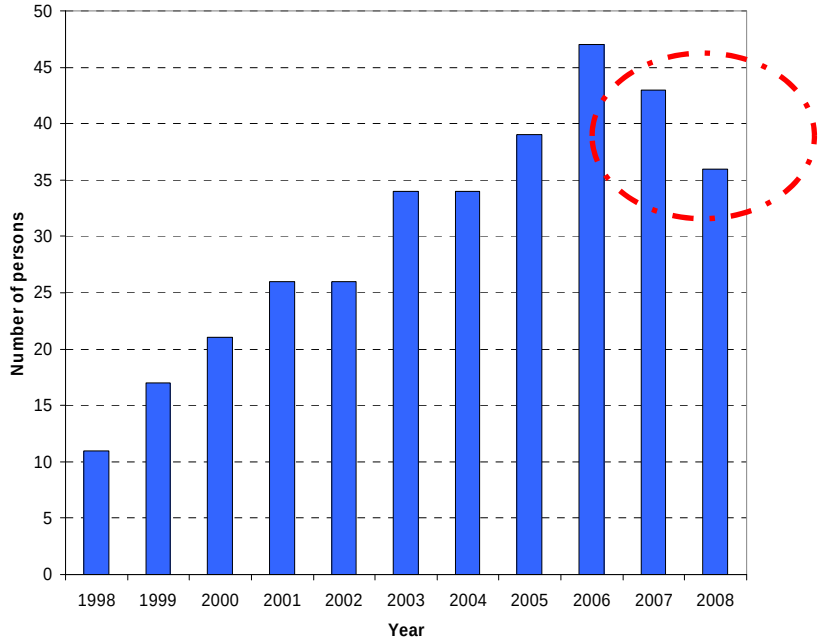
- Audit, training and awareness of the danger and risk by the medical staff lead to a decrease of the extremity dose since 2007 (start of the audit)

- Decrease of the number of persons
  - 30% with a yearly dose > 50mSv

- Increase of PET-CT, etc and therapeutic application with beta and alpha

- Further follow up and action from regulatory body are needed to reduce this trend in extremity dose of medical staff

- ORAMED recommendations will be welcome



Thank you for your attention

Bern, Switzerland